USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Development of Translators for Filterable Metals Based Upon Watershed Characteristics

Focus Categories: NPP, TS, MOD

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Abstract

Loading of trace metals from point and non-point sources poses serious concerns for the water resources of the Midwest. Concern over the impacts of metals on receiving waters emphasizes the need for information on both the factors controlling export and fundamental information on metal speciation in the receiving waters. In a fundamental shift of policy, USEPA in late 1993, recommended that Aquatic Life Criteria (ALC) be expressed in terms of "dissolved" metal levels, instead of the historic "total recoverable" convention. State water resource managers and regulators must accomplish this with minimal guidance or ability to determine what is represented by the "dissolved" fraction, yet still protect the fragile health of many stream systems. In promulgating the new policy USEPA recommended that states develop dissolved metal translators, i.e. a ratio expressing the fraction of the total metal in the stream that is "dissolved". In the push for states to develop this capability, translators are being developed with very limited or "suspect" data, and with no framework or model of the transferability of these constructs to different watersheds. What is needed is a quantitative model that is capable of predicting metal speciation (e.g. a translator) across geochemically diverse watersheds.

In this study we will model the partitioning of a suite of trace metals to environmental solids across geochemically contrasting environments. To accomplish this we will apply two general modeling strategies to a unique and large database of reliable trace metal data: (1) multi-variate regression with chemical vectors (2) multi-variate analysis of environmental characteristics in a GIS-based forrnat. We expect to provide a basis for assessment and prediction of metal speciation in divergent watersheds, and to determine whether these models are sufficiently accurate to provide regionalized and site-specific dissolved metal translators to regulatory agencies, watershed mangers, and modelers charged with regulating non-point and point loading. We will determine the most effective approach for establishing adequate translators and provide critical guidance on regional metal levels and particle partitioning (K,).

The methods developed provide regulators with a water resource management tool capable of providing spatially distributed estimates of the rates and distribution of groundwater recharge. In addition, these techniques might be used to evaluate the impacts of urbanization, land use changes, and climate change on the patterns and rates of recharge as well as provide inputs for the spatial distribution of recharge into regional groundwater flow models.